Analytical Instrumentation, Methods & Materials

High-Efficiency Modeling of Three-Dimensional Lumens

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Inventors: Patrick McMinn, David Beebe

The Wisconsin Alumni Research Foundation is seeking commercial partners interested in developing an automatable solution to generate cellularized lumens in a microwell plate. Establishing a high-throughput, automatable method to model lumen configurations will allow statistical comparison of physiologically relevant screening protocols for new drug treatments in lumen-associated diseases, including cancer, atherosclerosis, thrombosis, rheumatoid arthritis and lupus.

Overview

Lumens are tubular structures pervasive throughout all body systems. Typical *in vitro* cell models used by pharmaceutical industries lack the dimensional complexity necessary to mimic lumen structures and concomitant cell-cell and cell-extracellular matrix interactions, limiting physiological relevance and interpretation. Current approaches to model the three-dimensional geometry typical for vasculature, respiratory/gastrointestinal tracts and liver sinusoids rely on custom PDMS-based devices and microfluidic methods that can be incompatible with industry standards including ISO for end-to-end precision and traceability.

The Invention

UW-Madison researchers have developed a method for creating adaptable configurations of cellularized lumen structures out of different extracellular matrices (ECMs) within the wells of a microtiter plate. Various combinations of connection channels and ECM lumens can be made to create setups suitable for gradient formation, double lumens, liquid flow and intersecting lumens. Unlike current microfluidic methods, this method is compatible with existing laboratory liquid dispensing and detection infrastructure. The process enables high-throughput research and automation using a liquid handling robot to provide screening opportunities for new drug treatments in lumen-associated disease.

Applications

- High-throughput modeling of lumen structures including blood vessels, ductal cells and lymphatic vessels in a microtiter dish
- Industry standard modeling of lumen-associated biological and/or disease processes *in vitro*, including angiogenesis, metastasis, atherosclerosis, thrombosis, immune cell trafficking
- Performance monitoring and quality control

Key Benefits

- Benchmark lumen production will allow for better understanding of disease mechanisms and provide screening opportunities for new drug treatments.
- Ease of use
- Interface standardization
- Automatable

Additional Information

For More Information About the Inventors

- David Beebe

Publications

- Virumbrales-Muñoz et al. Microfluidic lumen-based systems for advancing tubular organ modeling. Chem Soc Rev. 2020 Sep 1;49(17):6402-6442. doi: 10.1039/d0cs00705f. PMID: 32760967; PMCID: PMC7521761.

Tech Fields

- Analytical Instrumentation, Methods & Materials : Microfluidics

For current licensing status, please contact Jeanine Burmania at jeanine@warf.org or 608-960-9846